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(54) **PRODUCT, METHOD, AND APPARATUS FOR INSTALLING A SECOND PROGRAM BASED ON A CALL FROM A FIRST PROGRAM**

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CPC ... ***G06F 8/61*** (2013.01); ***G06F 8/62*** (2013.01)

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None
See application file for complete search history.

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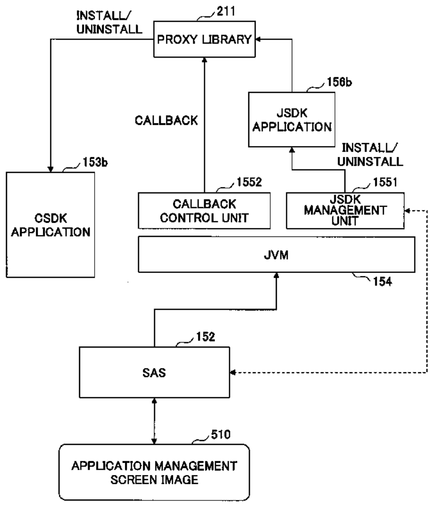
(57) **ABSTRACT**

An install method executed by an apparatus, including receiving a call from a first program when the first program is activated; and installing a second program that is used by the first program, in response to the call.

13 Claims, 11 Drawing Sheets



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JP	2006-311590	11/2006
JP	2007-048270	2/2007
JP	2007-049677	2/2007
JP	2007-109218	4/2007
JP	2007-109219	4/2007
JP	2007-279959	10/2007
JP	2008507775	3/2008
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FIG.1

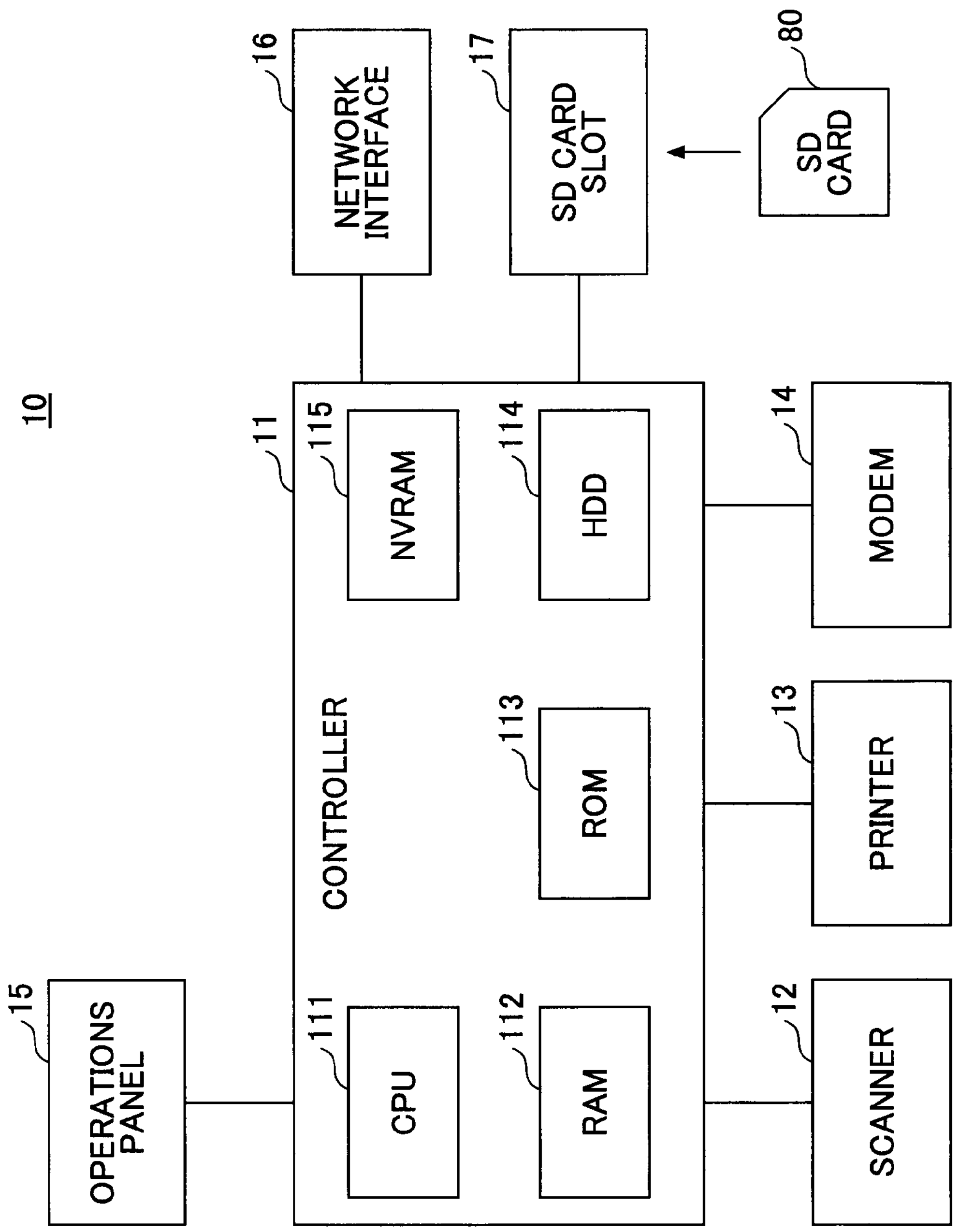

10
OPERATIONS PANEL
15
CONTROLLER
11
CPU
111
RAM
112
ROM
113
HDD
114
NVRAM
115
NETWORK INTERFACE
16
SD CARD SLOT
17
SD CARD
80
SCANNER
12
PRINTER
13
MODEM
14

FIG.2

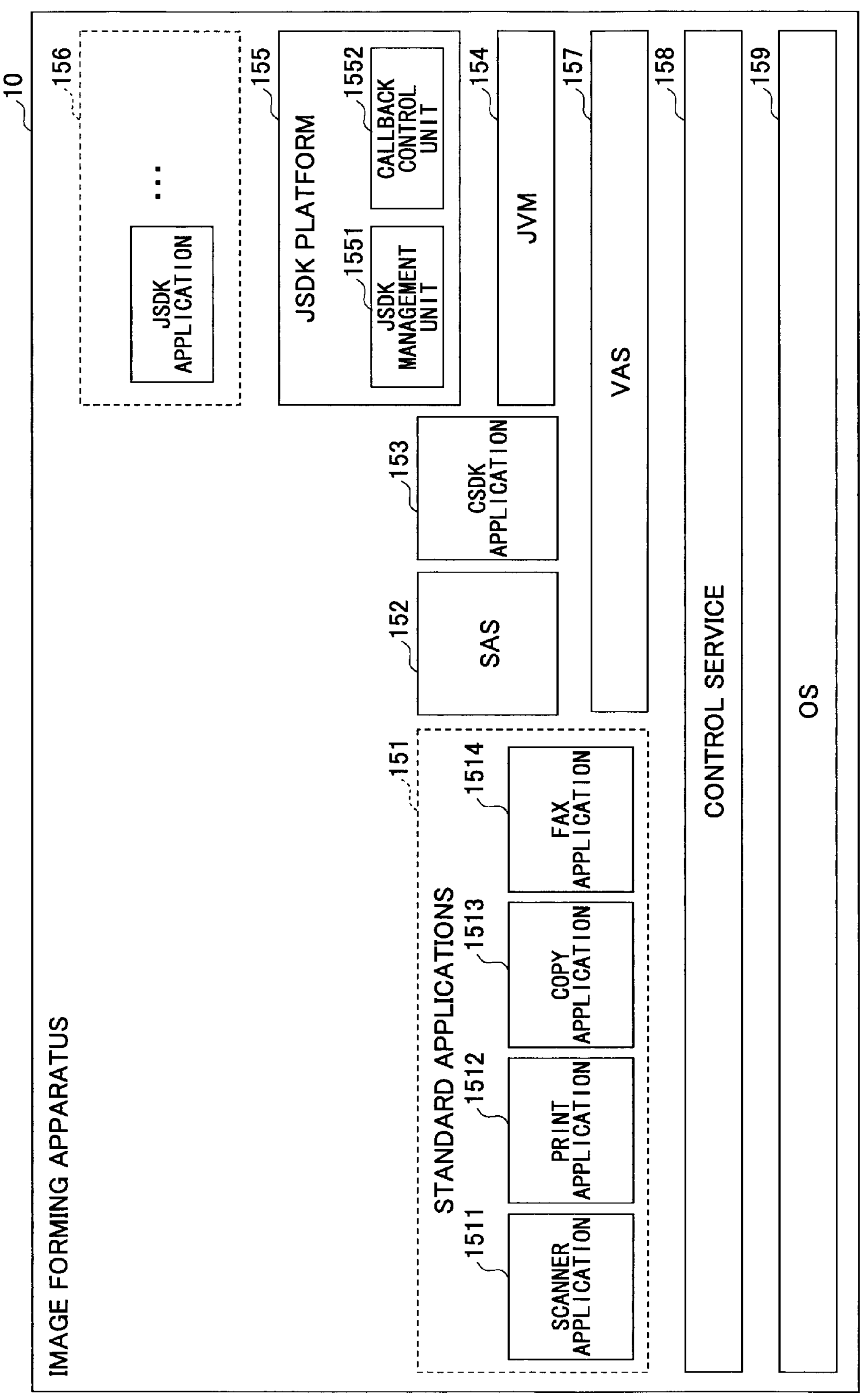

10
IMAGE FORMING APPARATUS
156
JSDK APPLICATION
...
155
JSDK PLATFORM
1551
JSDK MANAGEMENT UNIT
1552
CALLBACK CONTROL UNIT
154
JVM
153
CSDK APPLICATION
152
SAS
151
STANDARD APPLICATIONS
1511
SCANNER APPLICATION
1512
PRINT APPLICATION
1513
COPY APPLICATION
1514
FAX APPLICATION
157
VAS
158
CONTROL SERVICE
159
OS

FIG.3

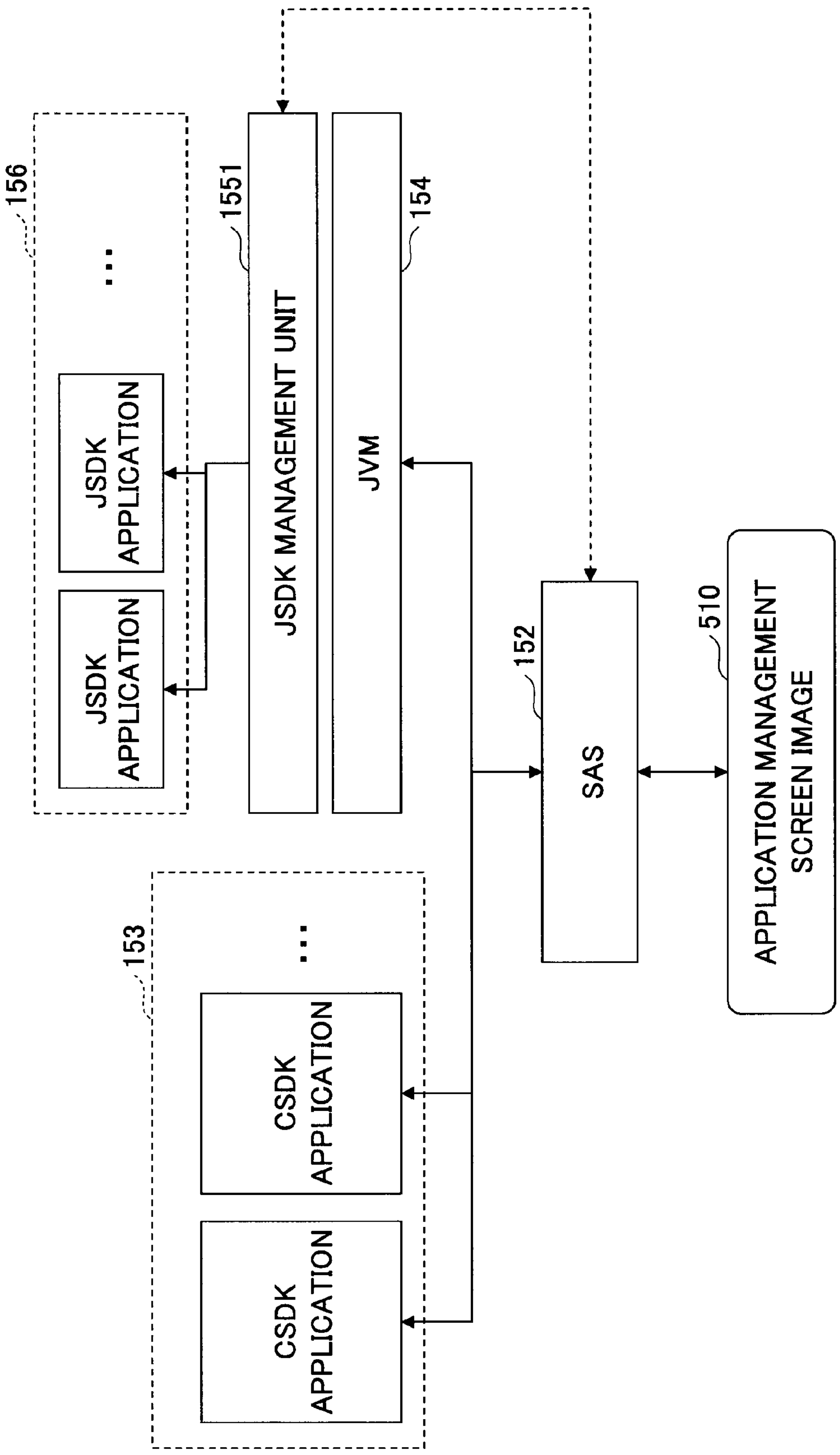

156
JSDK APPLICATION
JSDK APPLICATION
...
1551
JSDK MANAGEMENT UNIT
154
JVM
153
CSDK APPLICATION
CSDK APPLICATION
...
152
SAS
510
APPLICATION MANAGEMENT SCREEN IMAGE

FIG.4

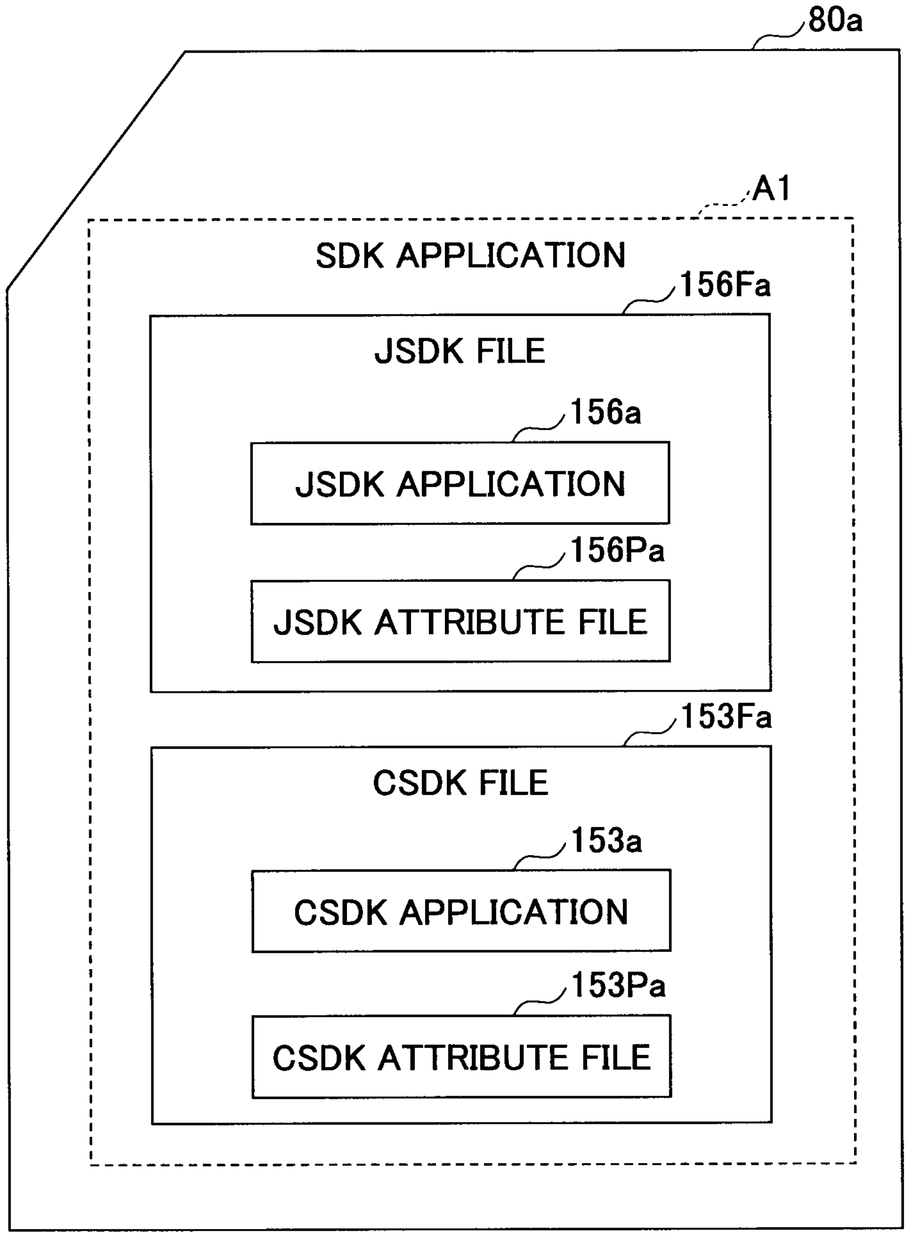
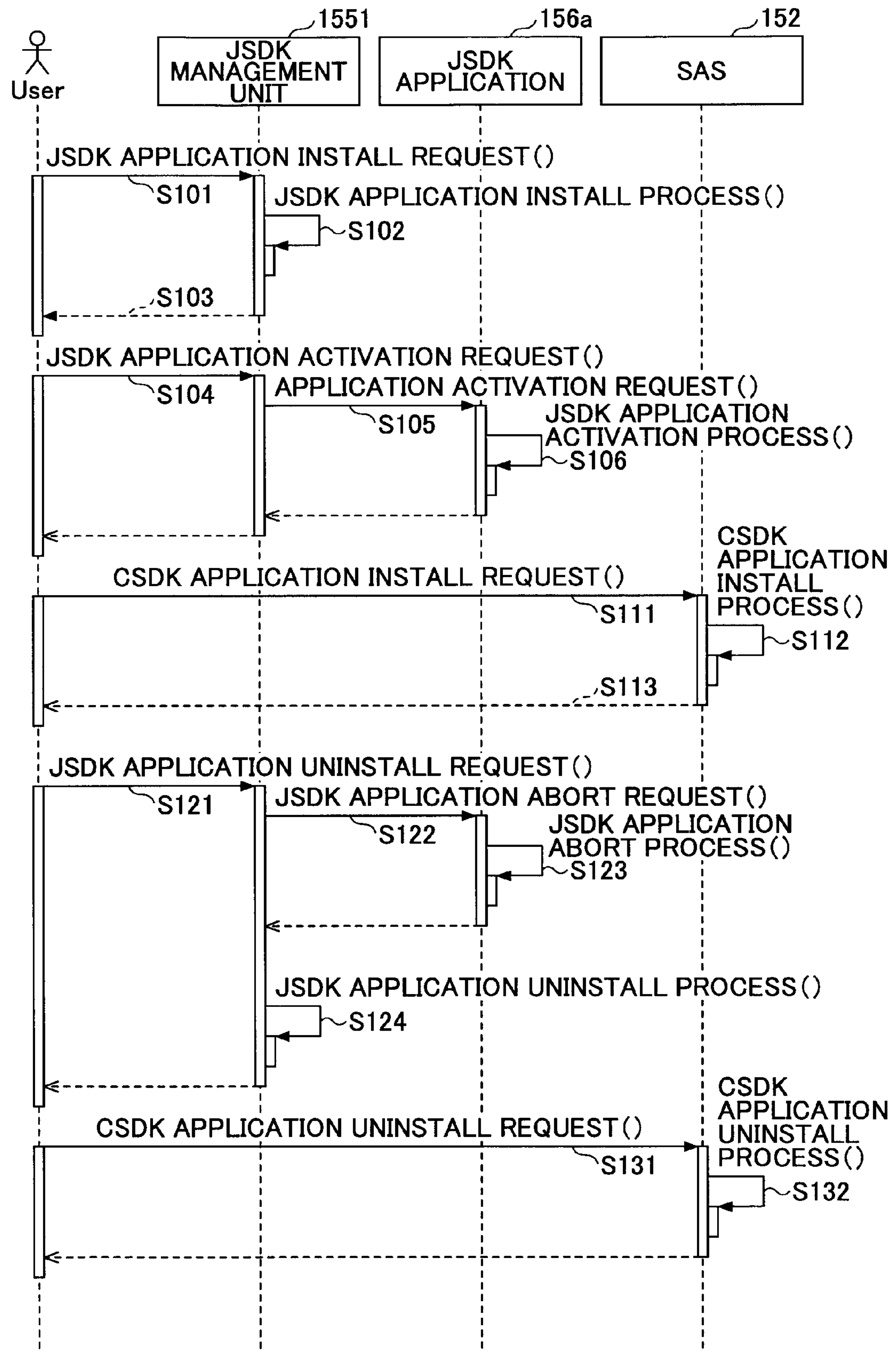

80a
A1
SDK APPLICATION
156Fa
JSDK FILE
156a
JSDK APPLICATION
156Pa
JSDK ATTRIBUTE FILE
153Fa
CSDK FILE
153a
CSDK APPLICATION
153Pa
CSDK ATTRIBUTE FILE

FIG.5



User
1551
JSDK MANAGEMENT UNIT
156a
JSDK APPLICATION
152
SAS
JSDK APPLICATION INSTALL REQUEST()
S101
JSDK APPLICATION INSTALL PROCESS()
S102
S103
JSDK APPLICATION ACTIVATION REQUEST()
S104
APPLICATION ACTIVATION REQUEST()
S105
JSDK APPLICATION ACTIVATION PROCESS()
S106
CSDK APPLICATION INSTALL REQUEST()
S111
CSDK APPLICATION INSTALL PROCESS()
S112
S113
JSDK APPLICATION UNINSTALL REQUEST()
S121
JSDK APPLICATION ABORT REQUEST()
S122
JSDK APPLICATION ABORT PROCESS()
S123
JSDK APPLICATION UNINSTALL PROCESS()
S124
CSDK APPLICATION UNINSTALL REQUEST()
S131
CSDK APPLICATION UNINSTALL PROCESS()
S132

FIG.6

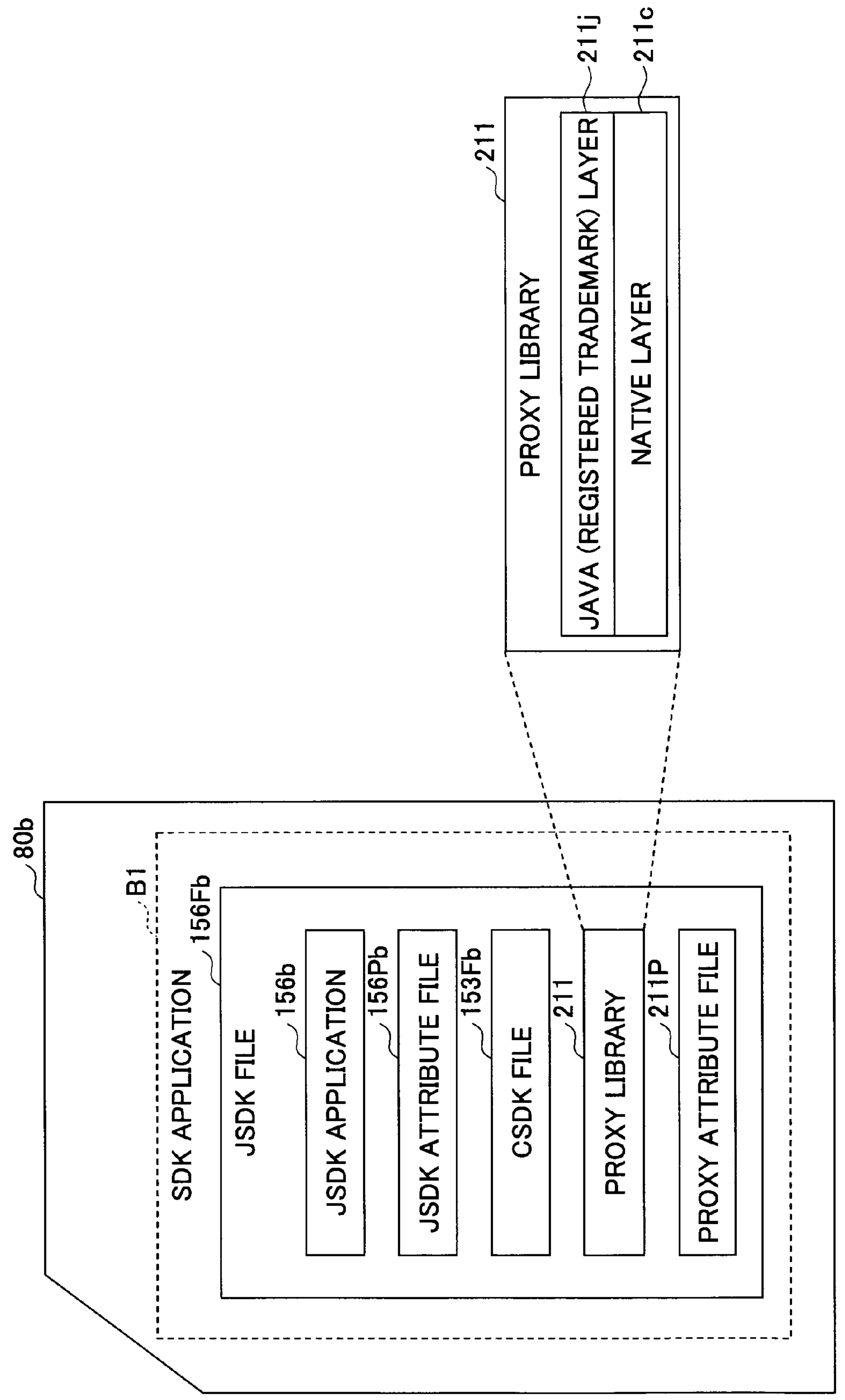

80b
B1
SDK APPLICATION
156Fb
JSDK FILE
156b
JSDK APPLICATION
156Pb
JSDK ATTRIBUTE FILE
153Fb
CSDK FILE
211
PROXY LIBRARY
211P
PROXY ATTRIBUTE FILE
211
PROXY LIBRARY
211j
JAVA (REGISTERED TRADEMARK) LAYER
211c
NATIVE LAYER

FIG.7

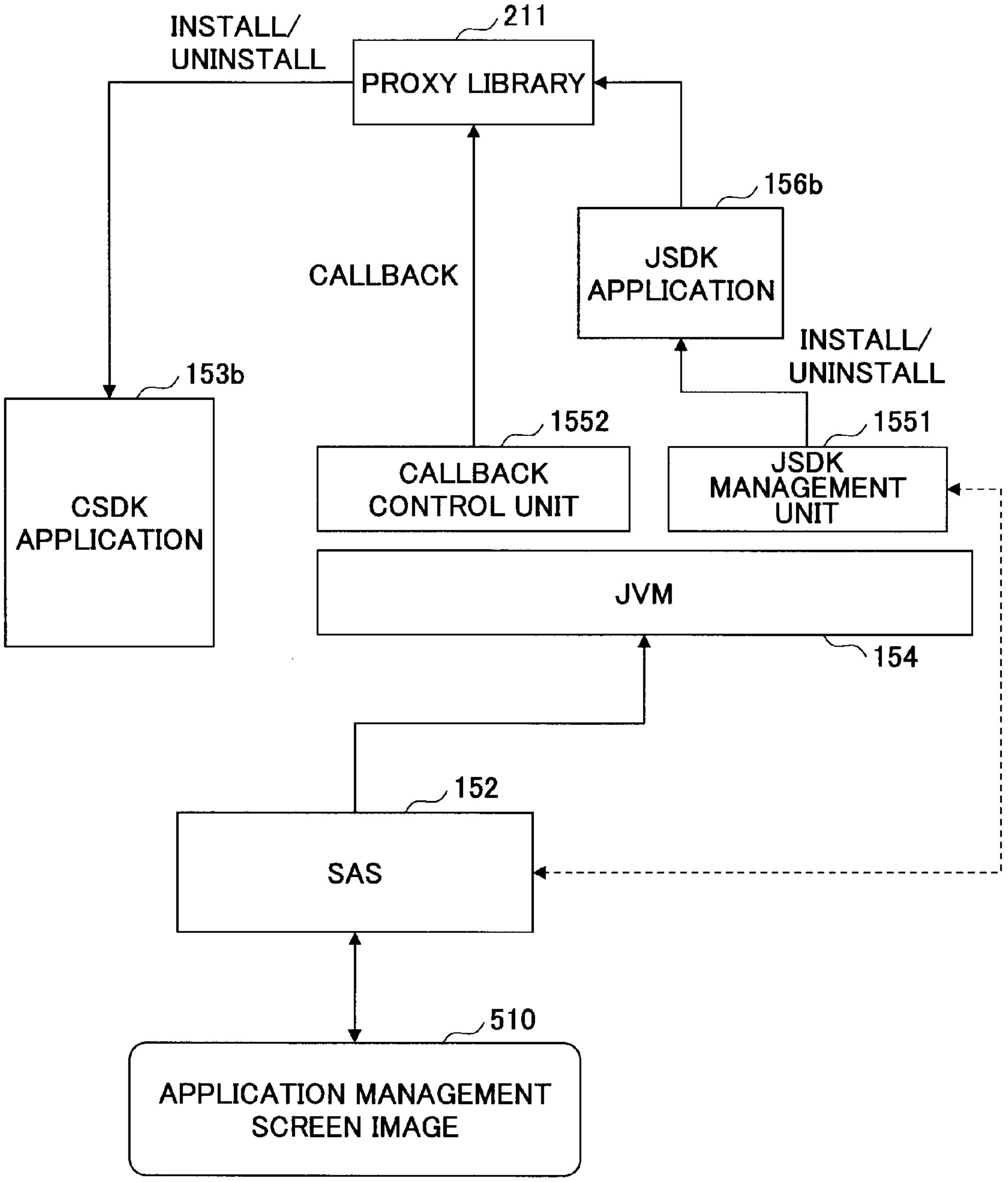

INSTALL/
UNINSTALL
211
PROXY LIBRARY
156b
JSDK
APPLICATION
CALLBACK
INSTALL/
UNINSTALL
153b
CSDK
APPLICATION
1552
CALLBACK
CONTROL UNIT
1551
JSDK
MANAGEMENT
UNIT
JVM
154
152
SAS
510
APPLICATION MANAGEMENT
SCREEN IMAGE

FIG.8

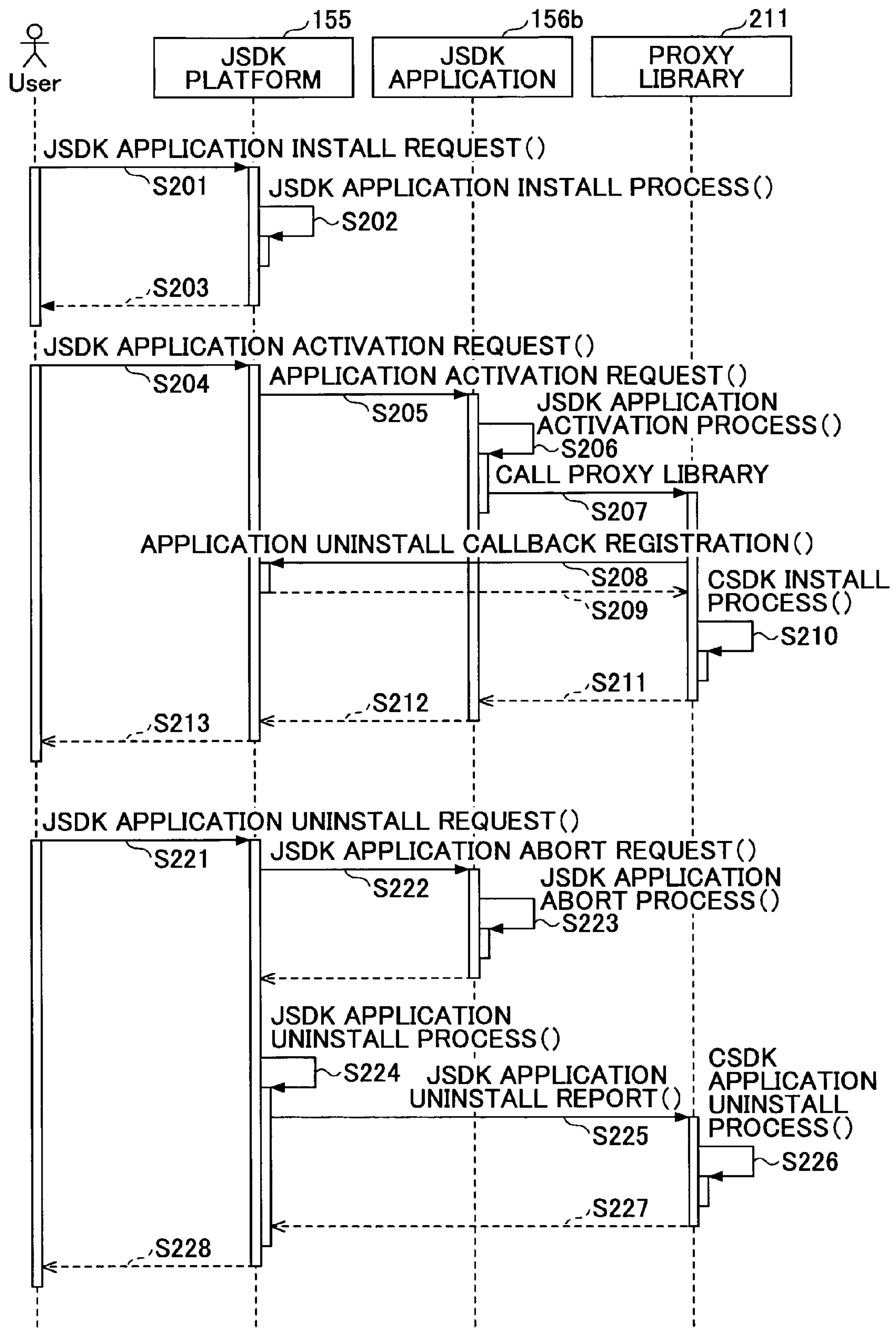

155
156b
211
User
JSDK PLATFORM
JSDK APPLICATION
PROXY LIBRARY
JSDK APPLICATION INSTALL REQUEST()
S201
JSDK APPLICATION INSTALL PROCESS()
S202
S203
JSDK APPLICATION ACTIVATION REQUEST()
S204
APPLICATION ACTIVATION REQUEST()
S205
JSDK APPLICATION ACTIVATION PROCESS()
S206
CALL PROXY LIBRARY
S207
APPLICATION UNINSTALL CALLBACK REGISTRATION()
S208
S209
CSDK INSTALL PROCESS()
S210
S211
S212
S213
JSDK APPLICATION UNINSTALL REQUEST()
S221
JSDK APPLICATION ABORT REQUEST()
S222
JSDK APPLICATION ABORT PROCESS()
S223
JSDK APPLICATION UNINSTALL PROCESS()
S224
JSDK APPLICATION UNINSTALL REPORT()
S225
CSDK APPLICATION UNINSTALL PROCESS()
S226
S227
S228

FIG.9

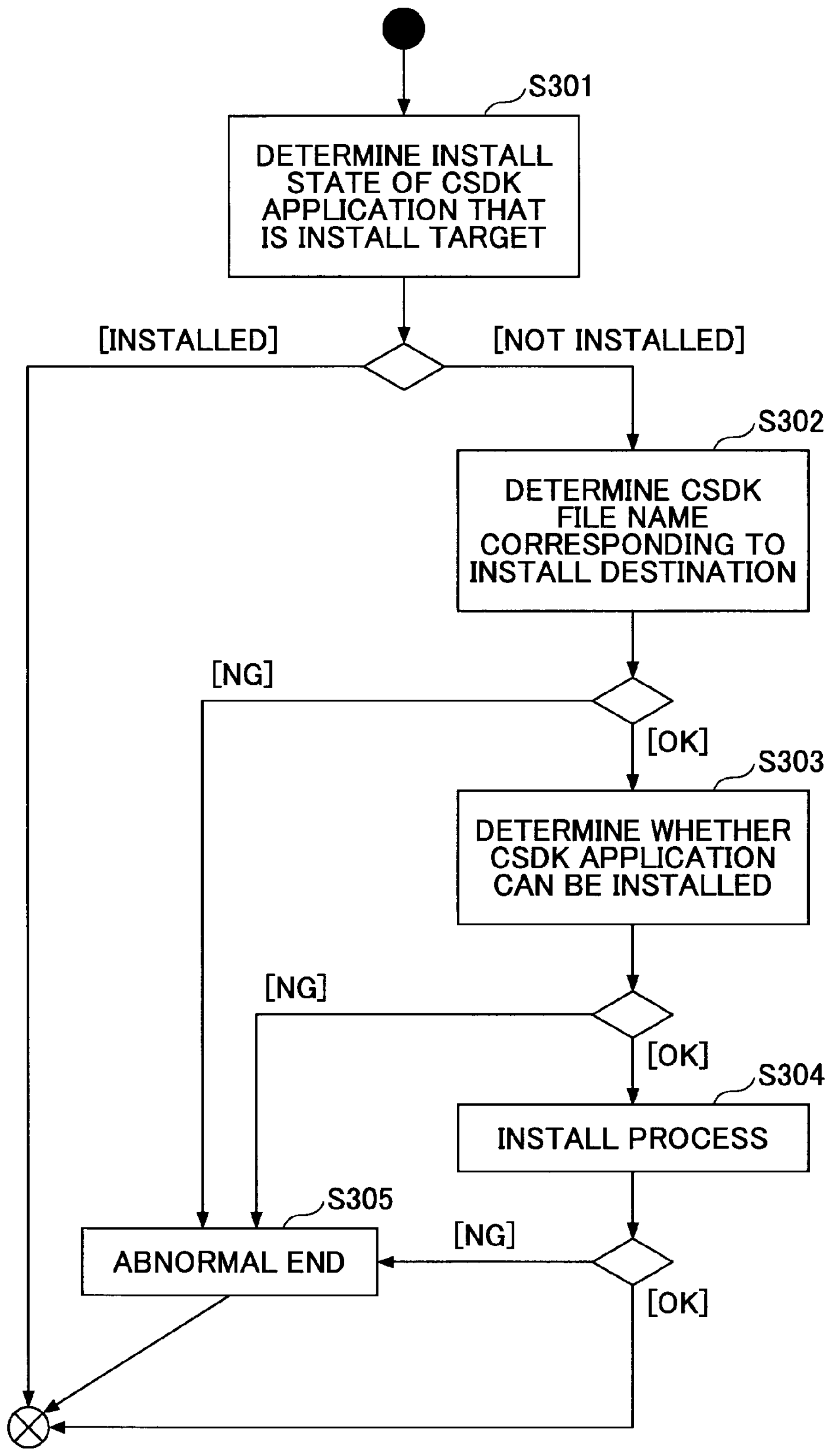
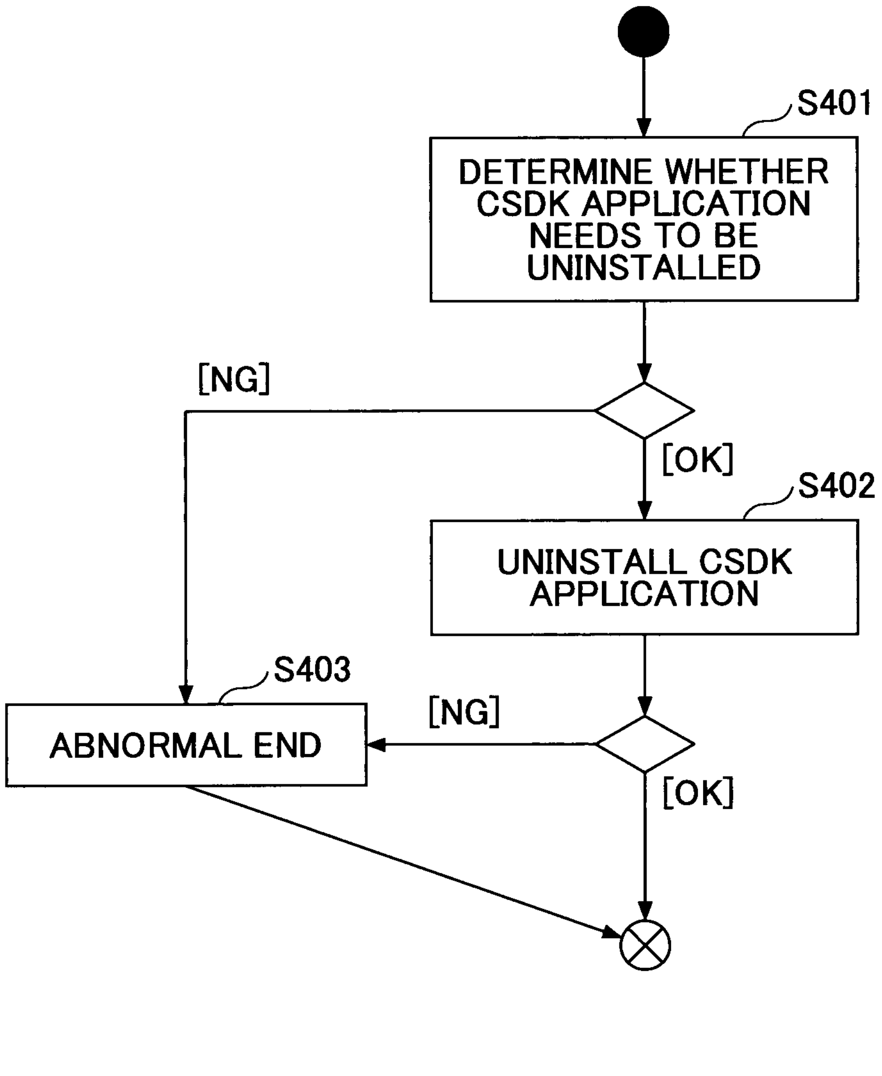

S301
DETERMINE INSTALL STATE OF CSDK APPLICATION THAT IS INSTALL TARGET
[INSTALLED]
[NOT INSTALLED]
S302
DETERMINE CSDK FILE NAME CORRESPONDING TO INSTALL DESTINATION
[NG]
[OK]
S303
DETERMINE WHETHER CSDK APPLICATION CAN BE INSTALLED
[NG]
[OK]
S304
INSTALL PROCESS
S305
ABNORMAL END
[NG]
[OK]

FIG.10

MODEL NAME	APPLICATION IDENTIFIER	CSDK FILE NAME
aaaa001	aaaa	csdk_app001
aaaa002	aaaa	csdk_app002
bbbb001	bbbb	csdk_app003
:	:	:

FIG.11


S401
DETERMINE WHETHER CSDK APPLICATION NEEDS TO BE UNINSTALLED
[NG]
[OK]
S402
UNINSTALL CSDK APPLICATION
S403
ABNORMAL END
[NG]
[OK]

PRODUCT, METHOD, AND APPARATUS FOR INSTALLING A SECOND PROGRAM BASED ON A CALL FROM A FIRST PROGRAM

TECHNICAL FIELD

The present invention relates to an install method and an apparatus, and more particularly to an install method and an apparatus for executing programs in the apparatus.

BACKGROUND ART

Conventionally, there are image forming apparatuses to which application programs can be added as plug-ins after shipment. For example, applications developed in C language (hereinafter, "C applications") and applications developed in Java (registered trademark) (hereinafter, "J applications") can be installed in the image forming apparatus described in patent document 1.

However, the platform for C applications and the platform for J applications are different. Specifically, the platform for J applications is formed by providing, on a platform for C applications, a platform provided with API (Application Program Interface) for Java (registered trademark) (the JSDK platform in patent document 1).

The model dependence of the JSDK platform is significantly lower than that of the platform for C applications. That is to say, the API of the JSDK platform is leveled out to be applicable to various model types. From the viewpoint of the developer of applications, it is more advantageous to develop applications as J applications. This is because in the case of J applications, the necessity of changing source codes for respective model types is low, and therefore development costs can be reduced.

However, the function range of API provided by JSDK platforms is narrower than that of platforms for C applications. That is to say, the number of functions that can be implemented by genuine J applications is less than that of genuine C applications. A genuine J application means a J application that is configured with only program modules that operate on a JSDK platform.

Thus, if a function cannot be implemented only by a J application, the function needs to be installed as a C application. In this case, a package including both a J application module and a C application module is sold as one application.

An application including both a J application and a C application may appear to be a single application to the user, but this application is perceived as two applications by an image forming apparatus that cannot recognize an application having such a configuration (i.e., a configuration including both a J application and a C application). Thus, the user needs to perform an install operation two times (the user needs to give an instruction to execute an install operation two times).

In such an image forming apparatus, by correcting the install mechanism of applications in consideration of applications having the above configuration, it is technically possible to execute both a process of installing a J application and a process of installing a C application by a single install instruction.

However, image forming apparatuses that cannot recognize an application including both a J application and a C application are already vastly commercially available and are being used by end users. It would require large amounts of cost and work to apply the above-described corrections to these image forming apparatuses.

Patent Document 1: Japanese Laid-Open Patent Application No. 2007-49677

DISCLOSURE OF INVENTION

The present invention has been made in view of the above-described problems, and it is an object of at least one embodiment of the present invention to provide an install method and an apparatus with which operations of installing programs can be simplified.

An aspect of the present invention provides a non-transitory computer-readable storage medium with an executable install program stored therein, wherein the install program instructs a processor of an apparatus to execute receiving a call from a first program when the first program is activated; and installing a second program that is used by the first program, in response to the call.

An aspect of the present invention provides an install method executed by an apparatus, the install method including receiving a call from a first program when the first program is activated; and installing a second program that is used by the first program, in response to the call.

An aspect of the present invention provides an apparatus including a receiving unit configured to receive a call from a first program when the first program is activated; and a first installing unit configured to install a second program that is used by the first program, in response to the call.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** illustrates an example of a hardware configuration of an image forming apparatus according to an embodiment of the present invention;

FIG. **2** illustrates a software configuration of the image forming apparatus according to an embodiment of the present invention;

FIG. **3** illustrates an example of a management mechanism of JSDK applications and CSDK applications;

FIG. **4** illustrates an example of a configuration of an SDK application set as an install target according to a first embodiment;

FIG. **5** is a sequence diagram for describing an example of processing procedures of an install process and an uninstall process of SDK applications according to the first embodiment;

FIG. **6** illustrates an example of a configuration of an SDK application set as an install target according to a second embodiment;

FIG. **7** illustrates an example of an install mechanism relevant to the SDK application including a proxy library;

FIG. **8** is a sequence diagram for describing an example of processing procedures of an install process and an uninstall process of SDK applications according to a second embodiment;

FIG. **9** is for describing an example of processing procedures of a process of installing a CSDK application performed by the proxy library;

FIG. **10** indicates an example of information recorded in a proxy attribute file; and

FIG. **11** is for describing an example of processing procedures of a process of uninstalling the CSDK application performed by the proxy library.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the present invention are described below with reference to the accompanying drawings. FIG. **1** illustrates an example of a hardware configuration of an image forming apparatus **10** according to an embodiment of the present invention. As shown in FIG. **1**, the image forming apparatus **10** includes hardware elements such as a controller **11**, a scanner **12**, a printer **13**, a modem **14**, an operations panel **15**, a network interface **16**, and an SD card slot **17**.

The controller **11** includes a CPU **111**, a RAM **112**, a ROM **113**, a HDD **114** and an NVRAM **115**. The ROM **113** records various programs and data used by the programs. The RAM **112** is used as a storage area for loading programs and a work area for the loaded programs. The CPU **111** processes the programs loaded in the RAM **112** to implement various functions. The HDD **114** records programs and various data items used by the programs. The NVRAM **115** records various setting information items.

The scanner **12** is a hardware element for scanning an original to obtain image data (image scanning unit). The printer **13** is a hardware element for printing data onto a sheet (printing unit). The modem **14** is a hardware element for connecting the image forming apparatus **10** to a telephone line to transmit and receive image data by fax communications. The operations panel **15** is a hardware element including an input unit such as a buttons for receiving input from a user, and a display unit such as a liquid crystal panel. The network interface **16** is a hardware element for connecting the image forming apparatus **10** to a network (wired or wireless) such as LAN. The SD card slot **17** is used for reading programs recorded in an SD card **80**. In the image forming apparatus **10**, in addition to programs recorded in the ROM **113**, programs recorded in the SD card **80** may also be loaded and executed in the RAM **112**.

FIG. **2** illustrates a software configuration of the image forming apparatus **10** according to an embodiment of the present invention. As shown in FIG. **2**, the image forming apparatus **10** includes standard applications **151**, SAS (SDK application service) **152**, a CSDK application **153**, JVM **154**, a JSDK platform **155**, JSDK applications **156**, a VAS (Virtual Application Service) **157**, a control service **158**, and an OS **159**.

The standard applications **151** are an assembly of applications that are installed as standard applications (with which the image forming apparatus **10** is shipped) in the image forming apparatus **10**. Examples shown in FIG. **2** are a scanner application **1511**, a print application **1512**, a copy application **1513**, and a FAX application **1514**. The scanner application **1511** executes scan jobs. The print application **1512** executes print jobs. The copy application **1513** executes copy jobs. The FAX application **1514** executes fax transmission jobs or fax reception jobs.

The control service **158** is a group of software modules for providing functions for controlling various hardware resources to upper-level applications, and executing basic functions of the image forming apparatus **10**.

The VAS **157** is for wrapping the interface of the control service **158**, and for absorbing the difference in the interface that arises as the control service **158** is upgraded. This ensures that programs operated on the VAS **157** (particularly the CSDK application **153**) are compatible with various versions of the control service **158**.

The CSDK application **153** and the JSDK application **156** are examples of SDK applications. An SDK application is developed as a plug-in to the image forming apparatus **10** for the purpose of expanding functions of the image forming apparatus **10**. The image forming apparatus **10** is provided with public APIs (Application Program Interface) dedicated to SDK applications. One API is in C language provided by the VAS **157**. The other API is in Java (registered trademark) language provided by the JSDK platform **155** described below. An SDK application created by using the API in C language is referred to as the CSDK application **153**. An SDK application created by using the API in Java (registered trademark) language is referred to as the JSDK application **156**. In FIG. **2**, the CSDK application **153** is expressed by one block (rectangle), but there may be plural CSDK applications **153** installed in a single image forming apparatus **10**.

The JVM **154** is a so-called Java (registered trademark) virtual machine, which is executed by interpreting instructions defined by Java (registered trademark) byte codes. In the present embodiment, the JVM **154** is installed as one of the CSDK applications.

The SAS **152** manages the life cycle of the CSDK application **153**. For example, the SAS **152** controls an install process, an activation process, an abort process, and an uninstall process that are performed on the CSDK application **153**.

The JSDK platform **155** provides an execution environment for the JSDK applications **156**. That is to say, the JSDK platform **155** provides an API in Java (registered trademark) language to the JSDK applications **156**. The JSDK platform **155** includes a JSDK management unit **1551** and a callback control unit **1552**. The JSDK management unit **1551** manages the life cycle of the JSDK applications **156**. For example, the JSDK management unit **1551** controls an install process, an activation process, an abort process, and an uninstall process that are performed on the JSDK applications **156**. The JSDK management unit **1551** may be installed as one of the JSDK applications **156**. The callback control unit **1552** controls a callback process. Callback corresponds to so-called callback in programming. That is to say, callback is a mechanism for generating callback to a corresponding report destination in response to an event being generated, by registering in advance the types of events and report destinations (callback function).

The OS **159** is a so-called operating system. The respective software items in the image forming apparatus **10** operate as processes or threads on the OS **159**.

FIG. **3** illustrates an example of a management mechanism of JSDK applications **156** and CSDK applications **153**. As shown in FIG. **3**, the life cycles of the CSDK applications **153** are managed by the SAS **152**. The respective CSDK applications **153** are activated as separate processes. The JVM **154** is one of the CSDK applications **153**. Therefore, the JVM **154** is also activated as one process by the SAS **152**.

Meanwhile, the life cycles of the JSDK applications **156** are managed by the JSDK management unit **1551**. The respective JSDK applications **156** are activated as separate threads on processes of the JVM **154**.

As described above, the CSDK applications **153** and the JSDK applications **156** have different management mechanisms because these applications have been developed in different languages. For example, if the SAS **152** attempts to directly control the JSDK application **156**, the SAS **152** needs to call an interface in Java (registered trademark) language from source codes in C language. In this case, high-level programming techniques are necessary, and the processing contents are cumbersome and complicated. Furthermore, the CSDK application **153** is executed as a process, while the JSDK application **156** is executed as a thread. Also considering this difference in the execution format, it is advantageous in terms of simplifying the management mechanism to provide separate application management mechanisms for the CSDK applications **153** and the JSDK applications **156**.

However, the user interfaces for the CSDK applications **153** and the JSDK application **156** are combined. Such a combined user interface is used by a user to instruct processes for installing, uninstalling, activating, and aborting applications. Specifically, an application management screen image **510** for providing the user interface is displayed on the operations panel **15** in an integrated fashion. When the CSDK application **153** is set as an operation target in the application management screen image **510**, the SAS **152** directly executes a process in response to the operated instruction (for example, an install process, an uninstall process, an activation process, and an abort process). Meanwhile, when the JSDK application **156** is set as an operation target in the application management screen image **510**, the SAS **152** reports an operation instruction to the JSDK management unit **1551**. In response to a report from the SAS **152**, the JSDK management unit **1551** executes a process in response to the operated instruction (for example, an install process, an uninstall process, an activation process, and an abort process).

Interactions between the SAS **152** and the JSDK management unit **1551** may be performed according a protocol that can be easily used regardless of the development language, such as HTTP (HyperText Transfer Protocol) and SOAP (Simple Object Access Protocol). Accordingly, there is no need to call an interface in Java (registered trademark) language from source codes in C language, and therefore there is no need for complicated processing contents.

A description is given of a configuration example of an SDK application that is an install target, according to a first embodiment. In the first embodiment, an SDK application is set as an install target, in which the CSDK application **153** and the JSDK application **156** are simply mixed. “Simply” means that the SDK application in which the CSDK application **153** and the JSDK application **156** are mixed is not created for the purpose of installing the SDK application as a single SDK application.

FIG. **4** illustrates an example of a configuration of an SDK application set as an install target according to the first embodiment.

As shown in FIG. **4**, an SDK application A**1** includes a JSDK file **156**Fa and a CSDK file **153**Fa. The JSDK file **156**Fa is a single archive file (for example, a JAR (Java (registered trademark) archive) file) including a JSDK application **156***a* and a JSDK attribute file **156**Pa. The JSDK application **156***a* is an entity of the JSDK application **156** in the SDK application A**1**. The JSDK attribute file **156**Pa includes configuration information of the JSDK file **156**Fa and attribute information relevant to the JSDK application **156***a* (for example, an identifier (application identifier) of the JSDK application **156***a*).

The CSDK file **153**Fa is a single archive file including a CSDK application **153***a* and a CSDK attribute file **153**Pa. The CSDK application **153***a* is an entity of the CSDK application **153** in the SDK application A**1**. The CSDK attribute file **153**Pa includes configuration information of the CSDK file **153**Fa and attribute information relevant to the CSDK application **153***a* (for example, an identifier (application identifier) of the CSDK application **153***a*).

The JSDK application **156***a* is the JSDK application **156** that implements predetermined functions by using the CSDK application **153***a*. That is to say, in the SDK application A**1**, the CSDK application **153***a* is positioned as a single program module. The JSDK application **156***a* may call a method of the CSDK application **153***a* by using, for example, JNI (Java (registered trademark) Native Interface).

In FIG. **4**, the SDK application A**1** is recorded in the SD card **80***a*. In this case, the JSDK file **156**Fa and the CSDK file **153**Fa are recorded in the SD card **80***a* as separate files. That is to say, in FIG. **4**, the rectangle formed with dashed lines

indicating the SDK application A**1** corresponds to the logical and conceptual range of a single SDK application A**1**.

The following describes processing procedures for installing and uninstalling the SDK application A**1** of FIG. **4** in the image forming apparatus **10**.

FIG. **5** is a sequence diagram for describing an example of processing procedures of an install process and an uninstall process of SDK applications according to the first embodiment. Before starting the process of FIG. **5**, the SD card **80***a* is inserted in the SD card slot **17**. A main screen image, which is one of the application management screen images **510**, is displayed on the operations panel **15** by the SAS **152**.

In the main screen image, when the user selects to execute install, the SAS **152** causes the operations panel **15** to display an install screen image. The install screen image includes a selection list of SDK applications, in which the JSDK application **156***a* and the CSDK application **153***a* are indicated in separate rows. The selection list is created based on the JSDK attribute file **156**Pa included in the JSDK file **156**Fa in the SD card **80***a*, and the CSDK attribute file **153**Pa included in the CSDK file **153**Fa in the SD card **80***a*. The install screen image is one of the application management screen images **510**.

In step S**101**, the user selects a row including the JSDK application **156***a* in the install screen image, and enters an instruction to execute install in the install screen image. The instruction to execute install is reported to the JSDK management unit **1551** via the SAS **152**. In FIG. **5**, the route via the SAS **152** is not shown.

Next, the JSDK management unit **1551** executes an install process of the JSDK application **156***a* (step S**102**). Specifically, the JSDK file **156**Fa is read from the SD card **80***a* and expanded. Furthermore, an entry including the application identifier of the JSDK application **156***a* is added to the install information of the JSDK applications **156** managed by the JSDK platform **155** with the use of a predetermined recording medium (list information of installed JSDK applications **156**). Furthermore, the JSDK application **156***a* and the JSDK attribute file **156**Pa are copied to a predetermined storage area (hereinafter, “JSDK install area”). When the install process ends, the JSDK management unit **1551** sends a response to the SAS **152** indicating that the install process has ended. According to this response, the fact that the install process has ended is reported to the user by the SAS **152** via the install screen image (step S**103**).

Next, when the user selects to execute activation in the main screen image, the SAS **152** causes the operations panel **15** to display an activation screen image. The activation screen image includes a list of the CSDK applications **153** and the JSDK applications **156** included in install information of the CSDK applications **153** (list information of installed CSDK applications **153**) or install information of the JSDK applications **156**, which are managed with the use of the NVRAM **115**. The SAS **152** acquires install information of the JSDK application **156** by referring to the JSDK management unit **1551**. The activation screen image is one of the application management screen images **510**.

The user selects a row including the JSDK application **156***a* included in the activation screen image, and enters an activation instruction in the activation screen image (step S**104**). The activation instruction is reported to the JSDK management unit **1551** via the SAS **152**.

Next, the JSDK management unit **1551** enters a request to activate the JSDK application **156***a* (step S**105**). In response to the activation request, the JSDK application **156***a* is activated as a thread on the JVM **154** (step S**106**).

Next, in response to an instruction from the user, the SAS **152** causes the operations panel **15** to display the install screen image once again. The user selects a row including CSDK application **153***a* in the install screen image, and enters an instruction to execute install in the install screen image (step S**111**). Next, the SAS **152** executes the process of installing the CSDK application **153***a* (step S**112**). Specifically, the CSDK file **153**Fa is read from the SD card **80***a* and expanded. Furthermore, an entry including the application identifier of the CSDK application **153***a* is added to the install information of the CSDK applications **153** managed with the use of the NVRAM **115**. Furthermore, the CSDK application **153***a* and the CSDK attribute file **153**Pa are copied to a predetermined storage area (hereinafter, "CSDK install area").

When the install process ends, the SAS **152** sends a report indicating that the install process has ended to the user via the install screen image (step S**113**).

When the SDK application A**1** becomes unnecessary, the user selects to execute uninstall in the main screen image. The SAS **152** causes the operations panel **15** to display an uninstall screen image. The uninstall screen image includes a list of the CSDK applications **153** and the JSDK applications **156** included in the install information of the CSDK applications **153** or the install information of the JSDK applications **156**. The uninstall screen image is one of the application management screen images **510**.

The user selects a row of the JSDK application **156***a* included in the uninstall screen image, and enters an uninstall instruction via the uninstall screen image (step S**121**). The uninstall instruction is reported to the JSDK management unit **1551** via the SAS **152**.

In response to the uninstall instruction, the JSDK management unit **1551** enters a request to abort the JSDK application **156***a* (step S**122**). In response to the abort request, the thread relevant to the JSDK application **156***a* ends (step S**123**). Next, the JSDK management unit **1551** executes a process to uninstall the JSDK application **156***a* (step S**124**). For example, the entry of the JSDK application **156***a* is deleted from the install information of the JSDK applications **156** managed by the JSDK platform **155**. Furthermore, the JSDK application **156***a* and the JSDK attribute file **156**Pa that have been copied to the JSDK install area are deleted.

Next, the user selects a row including the CSDK application **153***a* in the uninstall screen image, and enters an instruction to execute uninstall in the uninstall screen image (step S**131**). In response to the uninstall instruction, the SAS **152** executes a process to uninstall the CSDK application **153***a* (step S**132**). For example, an entry relevant to the CSDK application **153***a* is deleted from the install information of the CSDK applications **153** that is managed with the use of the NVRAM **115**. Furthermore, the CSDK application **153***a* and the CSDK attribute file **153**Pa that have been copied to the CSDK install area are deleted.

As described above, in the first embodiment, although there is only a single SDK application A**1**, the install operation and the uninstall operation respectively require two steps (i.e., steps S**101** and S**111**, and steps S**121** and S**131**).

In order to address such redundancy, in a second embodiment, the SDK application is configured as indicated in FIG. **6**.

FIG. **6** illustrates an example of a configuration of an SDK application set as an install target according to the second embodiment.

As shown in FIG. **6**, an SD card **80***b* has one JSDK file **156**Fb recorded as an SDK application B**1**. The JSDK file **156**Fb is an archive file (for example, a JAR file) including a JSDK application **156***b*, a JSDK attribute file **156**Pb, a CSDK file **153**Fb, a proxy library **211**, and a proxy attribute file **211**P.

The JSDK application **156***b* is an entity of the JSDK application **156** in the SDK application B**1**. The JSDK attribute file **156**Pb includes configuration information of the JSDK file **156**Fb and attribute information relevant to the JSDK application **156***b* (for example, an application identifier of the JSDK application **156***b*).

The CSDK file **153**Fb is an archive file having a configuration similar to that of the CSDK file **153**Fa shown in FIG. **4**. That is to say, the CSDK file **153**Fb includes a CSDK application **153***b* (not shown) that is an entity of the CSDK application **153** in the SDK application B**1** and a CSDK attribute file **153**Pb (not shown) including configuration information of the CSDK file **153**Fb and attribute information relevant to the CSDK application **153***b* (for example, an application identifier of the CSDK application **153***b*).

As described above, in the second embodiment, the CSDK application **153***b* is stored in the JAR file of the JSDK application **156***b*.

In the second embodiment, the dependency relationship between the JSDK application **156***b* and the CSDK application **153***b* is the same as the dependency relationship between the JSDK application **156***a* and the CSDK application **153***a* in the first embodiment. That is to say, the JSDK application **156***b* uses the CSDK application **153***b* as a single program module.

The proxy library **211** is a program module (library) that executes an install process and an uninstall process on the CSDK application **153***b*. As shown in FIG. **6**, the proxy library **211** includes a Java (registered trademark) layer **211***j* and a native layer **211***c*. The Java (registered trademark) layer **211***j* is for providing an interface (method, etc.) for the JSDK application **156***b*, and is implemented in Java (registered trademark) language. In the native layer **211***c*, algorithms of the install process and the uninstall process are implemented in C language. That is to say, in the proxy library **211**, essential functions are implemented in C language, and the parts that are implemented in C language are wrapped by Java (registered trademark). The essential functions of the proxy library **211** are implemented in C language for the following reason. That is, the proxy library **211** needs to access the NVRAM **115**, but it is difficult to implement the function of accessing the NVRAM **115** in Java (registered trademark) language. Furthermore, the proxy library **211** includes the Java (registered trademark) layer **211***j* for the purpose of facilitating the operation of using (calling) the proxy library **211** performed by the JSDK application **156***b*. For example, the proxy library **211** is included in the JSDK application **156***b* as a single JAR file.

The proxy attribute file **211**P includes information necessary for the operation of installing the CSDK application **153***b* performed by the proxy library **211**.

A description is given of an install mechanism of the image forming apparatus **10**, relevant to the SDK application including the proxy library **211**. FIG. **7** illustrates an example of an install mechanism relevant to the SDK application including the proxy library **211**.

As shown in FIG. **7**, the operation of installing the JSDK application **156***b* is performed in the same manner as that of the first embodiment. That is to say, an instruction entered in the application management screen image **510** is reported from the SAS **152** to the JSDK management unit **1551**. In response to the reported instruction, the JSDK management unit **1551** installs or uninstalls the JSDK application **156***b*.

The installed JSDK application **156***b* calls the proxy library **211** when activated. In response to the call, the proxy library **211** executes the process of installing the CSDK application **153***b* on behalf of the SAS **152**.

When the JSDK application **156***b* is uninstalled, this effect is called back (reported) to the proxy library **211** by the callback control unit **1552**. The proxy library **211** detects that the JSDK application **156***b* has been uninstalled based on the callback. In response to the uninstall being detected, the proxy library **211** executes the process of uninstalling the CSDK application **153***b* on behalf of the SAS **152**.

As described above, in the SDK application B**1** including the proxy library **211**, the proxy library **211** performs the install process and the uninstall process on the CSDK application **153***b*, on behalf of the SAS **152**.

A description is given of processing procedures of installing and uninstalling the SDK application B**1** shown in FIG. **6** in the image forming apparatus **10**.

FIG. **8** is a sequence diagram for describing an example of processing procedures of an install process and an uninstall process of SDK applications according to the second embodiment. Before starting the process of FIG. **8**, the SD card **80***b* of FIG. **6** is inserted in the SD card slot **17**. A main screen image, which is one of the application management screen images **510**, is displayed on the operations panel **15** by the SAS **152**.

In the main screen image, when the user selects to execute install, the SAS **152** causes the operations panel **15** to display an install screen image including a row including the JSDK application **156***b* as the selection candidate. The install screen image is created based on the JSDK attribute file **156**Pb included in the JSDK file **156**Fb in the SD card **80***b*.

In step S**201**, the user selects a row including the JSDK application **156***b* in the install screen image, and enters an instruction to execute install in the install screen image. The instruction to execute install is reported to the JSDK management unit **1551** via the SAS **152**. In FIG. **8**, the route via the SAS **152** is not shown.

Next, the JSDK management unit **1551** executes an install process of the JSDK application **156***b* (step S**202**). Specifically, the JSDK file **156**Fb is read from the SD card **80***b* and expanded. Furthermore, an entry including the application identifier of the JSDK application **156***b* is added to the install information of the JSDK applications **156** managed by the JSDK platform **155** with the use of a predetermined recording medium. Furthermore, the JSDK application **156***b*, the JSDK attribute file **156**Pb, the CSDK file **153**Fb, the proxy library **211**, and the proxy attribute file **211**P are copied to the JSDK install area. The CSDK file **153**Fb, the proxy library **211**, and the proxy attribute file **211**P are recognized by the JSDK management unit **1551** as resource files of the JSDK application **156***b*. Thus, the JSDK management unit **1551** does not execute any special process on the CSDK file **153**Fb, the proxy library **211**, or the proxy attribute file **211**P. However, the install operation of the proxy library **211** can be completed by saving the proxy library **211** as a resource file of the JSDK application **156***b*. That is to say, the operation of installing the proxy library **211** is performed in association with the operation of installing the JSDK application **156***b* (i.e., the proxy library **211** is installed together with the JSDK application **156***b*).

When the install process ends, the JSDK management unit **1551** sends a response to the SAS **152** indicating that the install process has ended. According to this response, the fact that the install process has ended is reported to the user by the SAS **152** via the install screen image (step S**203**).

Next, when the user selects to execute activation in the main screen image, the SAS **152** causes the operations panel **15** to display an activation screen image. The activation screen image includes a list of the CSDK applications **153** and the JSDK applications **156** included in install information of the CSDK application **153** or install information of the JSDK applications **156**.

The user selects a row including the JSDK application **156***a* included in the activation screen image, and enters an activation instruction in the activation screen image (step S**204**). The activation instruction is reported to the JSDK management unit **1551** via the SAS **152**.

Next, the JSDK management unit **1551** enters a request to activate the JSDK application **156***b* (step S**205**). In response to the activation request, the JSDK application **156***b* is activated as a thread on the JVM **154** (step S**206**). The JSDK application **156***b* loads the proxy library **211** in the RAM **112**, and calls a predetermined method (or function) in the Java (registered trademark) layer **211***j* of the loaded proxy library **211** (step S**207**). That is to say, the proxy library **211** receives a call from the JSDK application **156***a*. In response to the proxy library **211** being loaded in the RAM **112**, the proxy attribute file **211**P is also loaded in the RAM **112**.

In response to the call, the proxy library **211** registers, in the callback control unit **1552** of the JSDK platform **155**, callback information used for sending a report indicating that the JSDK application **156***b* has been uninstalled to the proxy library **211** (step S**208**). That is to say, "JSDK application **156***b* uninstalled" is specified as an event, and a request is made to register callback information in which a predetermined method of the proxy library **211** is specified as the report destination (callback function). The callback control unit **1552** stores the callback information by using, for example, the RAM **112**, and sends a response to the proxy library **211** reporting that the callback information has been registered (step S**209**).

Next, the native layer **211***c* of the proxy library **211** executes the process of installing the CSDK application **153***b*, based on the CSDK file **153**Fb (step S**210**). Details of the install process are described below. After the install process has ended, the Java (registered trademark) layer **211***j* of the proxy library **211** sends, to the JSDK application **156***b* that is the call source, a response indicating results of the install process (step S**211**). Next, the JSDK application **156***b* returns the function of controlling processes to the JSDK management unit **1551** (step S**212**). The JSDK management unit **1551** reports, to the SAS **152**, that the JSDK application **156***b* has been activated. In response to the report, the SAS **152** displays a message on the activation screen image that the JSDK application **156***b* has been activated (step S**213**).

As described above, in the second embodiment, in response to the JSDK application **156***b* being activated, the proxy library **211** automatically executes the operation of installing the CSDK application **153***b*.

When the SDK application B**1** becomes unnecessary, the user selects to execute uninstall in the main screen image. The SAS **152** causes the operations panel **15** to display an uninstall screen image. The uninstall screen image includes a list of the CSDK applications **153** and the JSDK applications **156** included in the install information of the CSDK applications **153** or the install information of the JSDK applications **156**.

The user selects a row of the JSDK application **156***b* included in the uninstall screen image, and enters an uninstall instruction via the uninstall screen image (step S**221**). The uninstall instruction is reported to the JSDK management unit **1551** via the SAS **152**.

In response to the uninstall instruction, the JSDK management unit **1551** enters a request to abort the JSDK application **156***b* (step S**222**). In response to the abort request, the thread relevant to the JSDK application **156***a* ends (step S**223**). Next, the JSDK management unit **1551** executes a process to uninstall the JSDK application **156***b* (step S**224**). For example, the entry of the JSDK application **156***b* is deleted from the install information of the JSDK applications **156** managed by the JSDK platform **155**. Furthermore, the JSDK application **156***b*, the JSDK attribute file **156**Pb, the CSDK file **153**Fb, the proxy library **211**, and the proxy attribute file **211**P that have been copied to the JSDK install area are deleted.

Next, in response to the JSDK application **156***b* being uninstalled, the callback control unit **1552** of the JSDK platform **155** calls a callback function specified in the callback information registered at step S**208** (step S**225**). The callback function is a predetermined method of the Java (registered trademark) layer **211***j* of the proxy library **211**. Thus, the predetermined method is called. As a result, it is reported to the proxy library **211** that the JSDK application **156***b* has been uninstalled. In step S**224**, the module file of the proxy library **211** is deleted; however, the contents of the module file and the proxy attribute file **211**P are loaded in the RAM **112**. Next, the native layer **211***c* of the proxy library **211** executes the process of uninstalling the CSDK application **153***b* (step S**226**).

After the uninstall process, the Java (registered trademark) layer **211***j* of the proxy library **211** returns the function of controlling processes to the callback control unit **1552** that is the call source (step S**227**). Next, the JSDK management unit **1551** reports to the SAS **152** that the JSDK application **156***b* has been uninstalled. In response to the report, the SAS **152** causes the uninstall screen image to display the effect that the JSDK application **156***b* has been uninstalled (step S**228**).

As described above, in the second embodiment, in response to the JSDK application **156***b* being uninstalled, the proxy library **211** automatically executes the process of uninstalling the CSDK application **153***b*.

Next, a description is given of details of step S**210** in FIG. **8**. FIG. **9** is for describing an example of processing procedures of a process of installing a CSDK application performed by the proxy library **211**. In the description of FIG. **9**, the native layer **211***c* of the proxy library **211** is referred to as the proxy library **211**.

In step S**301**, the proxy library **211** determines whether the CSDK application **153***b* that is the install target is already installed in the image forming apparatus **10**. The determination is made by comparing or cross-checking the proxy attribute file **211**P with the install information of the CSDK applications **153** managed with the use of the NVRAM **115**.

FIG. **10** indicates an example of information recorded in the proxy attribute file **211**P. As shown in FIG. **10**, in the proxy attribute file **211**P, the model name, the application identifier, and the CSDK file name are recorded for each model of the image forming apparatus **10** into which the CSDK application **153***b* can be installed.

The model name is the name of the model of the image forming apparatus **10**. The application identifier is the identifier of the CSDK application **153***b*. Even when the same function is implemented by two CSDK applications **153***b*, different application identifiers are given to these two CSDK applications **153***b* if the contents of the files are different depending on the model type. The CSDK file name is the name of the CSDK file **153**Fb. FIG. **10** shows an example in which a common CSDK file **153**Fb is applicable to different model types. Therefore, a common application identifier corresponds to different model types.

When different CSDK files **153**Fb are to be applied according to the model type, the application identifiers and CSDK file names are different. In this case, the JSDK file **156**Fb includes plural CSDK files **153**Fb.

In step S**301**, it is determined whether a particular application identifier is included in install information of the CSDK applications **153** managed with the use of the NVRAM **115**. Specifically, the particular application identifier means the same application identifier as the application identifier in the proxy attribute file **211**P associated with the model name of the image forming apparatus **10** that is the install destination. When the corresponding application identifier is included in the install information of the CSDK applications **153**, the proxy library **211** determines that the CSDK application **153***b* is already installed, and normally ends the process of FIG. **9**. Thus, in this case, the process of installing the CSDK application **153***b* is not executed.

When the corresponding application identifier is not included in the install information of the CSDK applications **153**, the proxy library **211** determines that the CSDK application **153***b* is not yet installed. Next, the proxy library **211** determines the CSDK file name corresponding to the model name of the image forming apparatus **10** that is the install destination, based on the proxy attribute file **211**P (step S**302**).

When the CSDK file name corresponding to the model name of the image forming apparatus **10** that is the install destination is not recorded in the proxy attribute file **211**P, the proxy library **211** abnormally ends the process of FIG. **9** (step S**305**). Abnormally ending the process means to return, to the JSDK application **156***b*, a report indicating that the install process is unsuccessful.

When the CSDK file name corresponding to the model name of the image forming apparatus **10** that is the install destination is recorded in the proxy attribute file **211**P, the proxy library **211** determines whether the CSDK application **153***b* can be installed (step S**304**). For example, when there is an upper limit in the number of CSDK applications **153** that can be installed, or when there are any other limitations, it is determined whether the CSDK application **153***b* can be installed based on whether these upper limits or limitations may be exceeded by installing the CSDK application **153***b*.

When it is determined that the CSDK application **153***b* cannot be installed, the proxy library **211** abnormally ends the process of FIG. **9** (step S**305**). When it is determined that the CSDK application **153***b* can be installed, the proxy library **211** executes the process of installing the CSDK application **153***b*, based on the CSDK file **153**Fb relevant to the CSDK file name determined in step S**302** (step S**304**). Specifically, the CSDK attribute file **153**Pb saved in the JSDK install area in step S**202** of FIG. **8** is expanded, and the CSDK application **153***b* and the CSDK attribute file **153**Pb are saved in the CSDK install area. Furthermore, an entry including an application identifier of the CSDK application **153***b* is added to the install information of the CSDK applications **153** managed with the use of the NVRAM **115**.

When the install process is unsuccessful (for example, when the process of saving the CSDK application **153***b* in the CSDK install area or the process of adding install information is unsuccessful), the proxy library **211** abnormally ends the process of FIG. **9**.

Next, a detailed description is given of step S**226** in FIG. **8**. FIG. **11** is for describing an example of processing procedures of a process of uninstalling the CSDK application **153** performed by the proxy library **211**. In the description of FIG. **11**, the native layer **211***c* of the proxy library **211** is referred to as the proxy library **211**.

In step S**401**, the proxy library **211** determines whether the CSDK application **153***b* needs to be uninstalled. Specifically, for example, it is determined whether a particular application identifier is included in install information of the CSDK applications **153** managed with the use of the NVRAM **115**. Specifically, a particular application identifier means an application identifier of the CSDK application **153***b* that is an uninstall target specified in the factor of a callback function called in step S**225**. That is to say, it is determined whether an uninstall process is necessary based on whether the CSDK application **153***b* is installed.

When it is determined that an uninstall process is unnecessary (when the CSDK application **153***b* is not installed), the proxy library **211** abnormally ends the process of FIG. **11** (step S**403**). When it is determined that an uninstall process is necessary (when the CSDK application **153***b* is installed), the proxy library **211** executes a process of uninstalling the CSDK application **153***b* (step S**402**). For example, the entry of the CSDK application **153***b* is deleted from the install information of the CSDK applications **153** managed with the use of the NVRAM **115**. Furthermore, the CSDK application **153***b* and the CSDK attribute file **153**Pb that have been copied to the CSDK install area are deleted.

When the uninstall process is unsuccessful (for example, when the process of deleting the entry from the install information or the process of deleting the CSDK application **153***b* is unsuccessful), the proxy library **211** abnormally ends the process of FIG. **11** (step S**403**).

As described above, according to the present embodiment, when the JSDK application **156***b* is activated, the proxy library **211** automatically executes the process of installing the CSDK application **153***b*. Furthermore, when uninstalling the JSDK application **156***b*, the proxy library **211** automatically executes the process of uninstalling the CSDK application **153***b*.

Thus, the user does not need to perform an operation for installing the CSDK application **153***b*.

Furthermore, the logic of installing or uninstalling the CSDK application **153***b* is installed in the proxy library **211** which is distributed together with the JSDK application **156***b* (included in the JSDK file **156**Fb as part of the JSDK application **156***b*). That is to say, the logic does not need to be installed in an existing part of the install mechanism of the image forming apparatus **10** (such as the SAS **152** and the JSDK management unit **1551**). Accordingly, there is no need to make corrections on existing parts of the install mechanism of the image forming apparatus **10**.

Furthermore, the CSDK application **153***b* (CSDK file **153**Fb) is included in the JSDK file **156**Fb as part of the JSDK application **156***b*. Therefore, the SAS **152** can display the install target as one JSDK application **156***b*, on the install screen image. The JSDK management unit **1551** can take in (save) the CSDK application **153***b* (CSDK file **153**Fb) in the image forming apparatus **10**, by the same process as the process of installing the JSDK application **156***a* described with reference to FIG. **5**.

In the present embodiment, a description is made of an example of simplifying the process of installing the JSDK application **156** and the CSDK application **153**. However, the programming languages of the programs to be combined do not necessarily need to be different. Furthermore, the present application may also be applied to a case of combining three or more programs. Specifically, two or more types of JSDK applications **156** and two or more types of CSDK applications **153** may be included in the JSDK file **156**Fb.

According to an embodiment of the present invention, the operation of installing programs can be simplified.

The present invention is not limited to the specific embodiments described herein, and variations and modifications may be made without departing from the scope of the present invention.

The present application is based on Japanese Priority Application No. 2010-208213 filed on Sep. 16, 2010 with the Japan Patent Office, the entire contents of which are hereby incorporated by reference.

The invention claimed is:

1. A non-transitory computer-readable storage medium with an executable install program stored therein, wherein the executable install program instructs a processor of an apparatus to execute:

receiving a call from a first program executable on the apparatus when the first program is activated;

checking stored attribute information that indicates a correspondence between multiple apparatus types and multiple programs;

identifying a second program that corresponds to the apparatus based on the checked attribute information; and

in response to the call, installing the second program that is used by the first program, and setting, in the apparatus, callback information used for sending, to the executable install program, a report indicating that the first program has been uninstalled,

wherein the first program and the second program are developed by different development languages, and when executing the first program, the first program is executed by calling a part of a plurality of program modules to be used, from the second program.

2. The non-transitory computer-readable storage medium according to claim **1**, further comprising:

installing the executable install program in the apparatus in association with the first program.

3. The non-transitory computer-readable storage medium according to claim **1**, further comprising:

uninstalling the second program in response to detecting that the first program has been uninstalled.

4. The non-transitory computer-readable storage medium according to claim **3**, wherein

the uninstalling of the second program includes uninstalling the second program in response to receiving the report indicating that the first program has been uninstalled based on the callback information.

5. An install method executed by an apparatus, the install method comprising:

receiving a call from a first program executable on the apparatus when the first program is activated;

checking stored attribute information that indicates a correspondence between multiple apparatus types and multiple programs;

identifying a second program that corresponds to the apparatus based on the checked attribute information; and

in response to the call, installing the second program that is used by the first program, and setting, in the apparatus, callback information used for reporting that the first program has been uninstalled,

wherein the first program and the second program are developed by different development languages, and when executing the first program, the first program is executed by calling a part of a plurality of program modules to be used, from the second program.

6. The install method according to claim **5**, further comprising:

installing an install program in the apparatus in association with the first program, the install program causing the apparatus to execute the receiving of the call and the installing of the second program.

7. The install method according to claim **5**, further comprising:

uninstalling the second program in response to detecting that the first program has been uninstalled.

8. The install method according to claim **7**, wherein

the uninstalling of the second program includes uninstalling the second program in response to detecting that the first program has been uninstalled based on the callback information.

9. An apparatus comprising:

a memory that stores a program; and

a processor, coupled to the memory, that executes the program,

wherein the program which, when executed by the processor, causes the apparatus to:

receive a call from a first program executable on the apparatus when the first program is activated;

check stored attribute information that indicates a correspondence between multiple apparatus types and multiple programs;

identify a second program that corresponds to the apparatus based on the checked attribute information; and

in response to the call, install the second program that is used by the first program, and set, in the apparatus, callback information used for reporting that the first program has been uninstalled,

wherein the first program and the second program are developed by different development languages, and when executing the first program, the first program is executed by calling a part of a plurality of program modules to be used, from the second program.

10. The apparatus according to claim **9**, wherein the program further causes the apparatus to:

install an install program in the apparatus in association with the first program, the install program causing the apparatus to receive the call from the first program and install the second program.

11. The apparatus according to claim **9**, wherein the program further causes the apparatus to:

uninstall the second program in response to detecting that the first program has been uninstalled.

12. The apparatus according to claim **11**, wherein

the uninstall includes uninstalling the second program in response to detecting that the first program has been uninstalled based on the callback information.

13. The non-transitory computer-readable storage medium according to claim **1**, wherein the first program is a JSDK application and the second program is a CSDK application, the JSDK application calling a proxy library including the stored attribute information that includes a model name, an application identifier of the CSDK application, and a CSDK file name recorded for each model of an image forming apparatus into which the CSDK application can be installed, and wherein the proxy library is included in the JSDK application as a single JAR file.

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